



Rewarding Learning

**General Certificate of Secondary Education
2022**

Chemistry

Unit 2

Higher Tier

[GCM22]

MONDAY 20 JUNE, MORNING

MARK SCHEME

General Marking Instructions

Introduction

Mark schemes are intended to ensure that the GCSE examinations are marked consistently and fairly. The mark schemes provide markers with an indication of the nature and range of candidates' responses likely to be worthy of credit. They also set out the criteria which they should apply in allocating marks to candidates' responses.

Assessment objectives

Below are the assessment objectives for GCSE Chemistry.

Candidates must:

- AO1** Demonstrate knowledge and understanding of:
- scientific ideas;
 - scientific techniques and procedures.
- AO2** Apply knowledge and understanding of and develop skills in:
- scientific ideas;
 - scientific enquiry, techniques and procedures.
- AO3** Analyse scientific information and ideas to:
- interpret and evaluate;
 - make judgements and draw conclusions;
 - develop and improve experimental procedures.

Quality of candidates' responses

In marking the examination papers, examiners should be looking for a quality of response reflecting the level of maturity which may reasonably be expected of a 16-year-old which is the age at which the majority of candidates sit their GCSE examinations.

Flexibility in marking

Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, then examiners should seek the guidance of the Supervising Examiner.

Positive marking

Examiners are encouraged to be positive in their marking, giving appropriate credit for what candidates know, understand and can do rather than penalising candidates for errors or omissions. The exception to this for GCSE Chemistry is when Examiners are marking complex calculations when the Examiners are briefed to mark by error or omission. Examiners should make use of the whole of the available mark range for any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 16-year-old GCSE candidate.

Awarding zero marks

Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

Marking Calculations

In marking answers involving calculations, examiners should apply the 'carry error through' rule so that candidates are not penalised more than once for a computational error. To avoid a candidate being penalised, marks can be awarded where correct conclusions or inferences are made from their incorrect calculations.

Types of mark schemes

Mark schemes for tasks or questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

Levels of response

In deciding which level of response to award, examiners should look for the number of indicative content points in candidate responses to ensure that the answer has been written to coincide with the question. In deciding which mark within a particular level to award to any response, quality of communication will be assessed and examiners are expected to use their professional judgement.

The following guidance is provided to assist examiners.

- **Threshold performance:** Response which just merits inclusion in the level and should be awarded a mark at or near the bottom of the range.
- **High performance:** Response which fully satisfies the level description and should be awarded a mark at or near the top of the range.

Quality of written communication

Quality of written communication is taken into account in assessing candidates' responses to all tasks and questions that require them to respond in extended written form. These tasks and questions are marked on the basis of bands of response. The description for each band of response includes reference to the quality of written communication.

For conciseness, quality of written communication is distinguished within bands of response as follows:

Band A: Quality of written communication is excellent.

Band B: Quality of written communication is good.

Band C: Quality of written communication is basic.

Band D: Response not worthy of credit

In interpreting these band descriptions, examiners should refer to the more detailed guidance provided below:

Band A (Excellent): Excellent reference to scientific terminology. The candidate successfully selects and uses the most appropriate form and style of writing. Relevant material is organised with a high degree of clarity and coherence. There is widespread and accurate use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are of a sufficiently high standard to make meaning clear.

Band B (Good): Good reference to scientific terminology. The candidate makes a reasonable selection and use of an appropriate form and style of writing. Relevant material is organised with some clarity and coherence. There is some use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are sufficiently competent to make meaning clear.

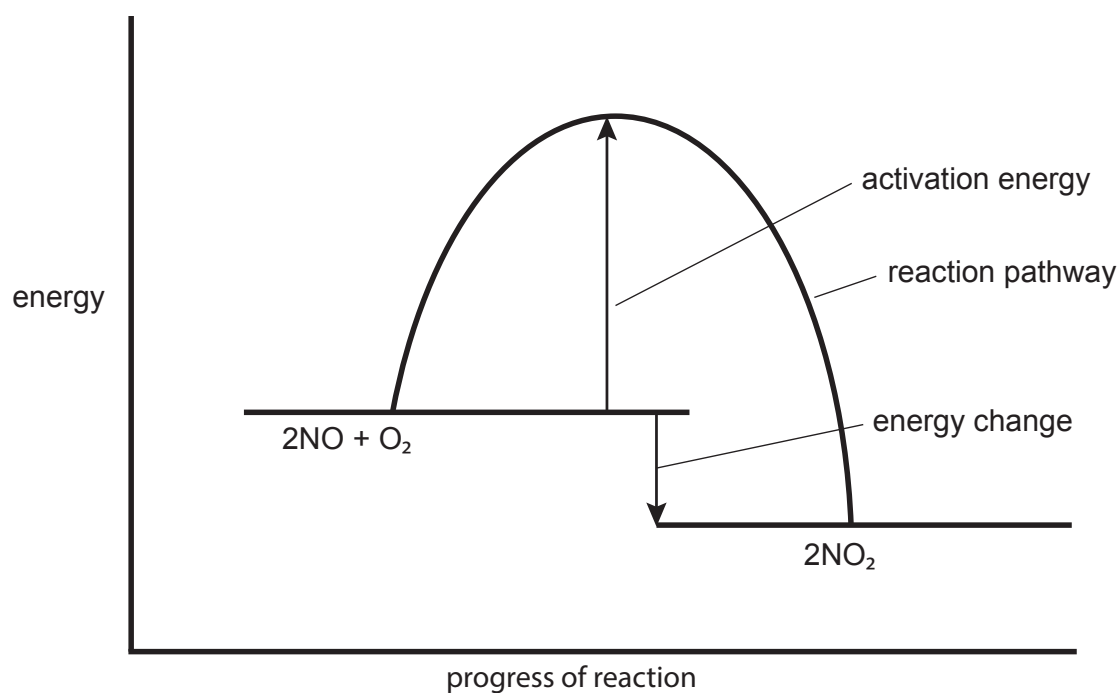
Band C (Basic): Basic reference to scientific terminology. The candidate makes only a limited selection and use of an appropriate form and style of writing. The organisation of material may lack clarity and coherence. There is little use of specialist vocabulary. Presentation, spelling, punctuation and grammar may be such that intended meaning is not clear.

COVID-19 Context

Given the unprecedented circumstances presented by the COVID-19 public health crisis, senior examiners, under the instruction of CCEA awarding organisation, are required to train assistant examiners to apply the mark scheme in case of disrupted learning and lost teaching time. The interpretation and intended application of the mark scheme for this examination series will be communicated through the standardising meeting by the Chief or Principal Examiner and will be monitored through the supervision period. This paragraph will apply to examination series in 2021–2022 only.

			AVAILABLE MARKS
1	(a)	moles of $\text{H}_2\text{O}_2 = \frac{17}{34} = 0.5$ [1]	
		moles of $\text{O}_2 = \frac{0.5}{2} = 0.25$ [1]	
		volume of $\text{O}_2 = 0.25 \times 24 = 6$ [1] dm^3 [1] (or $0.25 \times 24000 = 6000$ [1] cm^3 [1])	[4]
	(b)	(i) stopclock/timer	[1]
		(ii) manganese(IV) oxide/manganese dioxide	[1]
		(iii) provides an alternative reaction pathway [1] of lower activation energy [1]	[2]
		(iv) more particles (in the same volume) [1] more successful collisions [1] per unit time [1]	[3]
	(c)	(i) volume of $\text{O}_2 = 90$ [1] cm^3	
		moles of $\text{O}_2 = \frac{90}{24000} = 0.00375$ [1]	[2]
		(ii) hydrogen peroxide used up	[1]
(d)	atom economy = $\frac{34}{267} \times 100 = 12.7\%$	[2]	
(e)	100% atom economy/Q is regenerated	[1]	
			17

- 2 (a) rates of forward reaction and reverse reaction are equal [1]
amounts of reactants and products remain constant [1] [2]
- (b) yield increases [1]
position of equilibrium moves to the right [1]
to side of fewer gas moles/3 moles of gas on left and 2 on right [1] [3]
- (c) (i) decreases yield [1]
- (ii) position of equilibrium moves to the left [1]
forward reaction is exothermic/reverse reaction is
endothermic/absorbs heat [1] [2]
- (d) level of products below level of reactants [1]
energy change between energy levels [1]
reaction pathway [1]
activation energy [1] [4]



AVAILABLE
MARKS

12

- 3 (a) any **two** from:
 same general formula [1]
 differ by a CH₂ unit [1]
 gradation in physical properties [1]
 similar chemical properties [1] [2]
- (b) C=C [1]
 OH [1]
 COOH [1] [3]
- (c) alkanes do not have a functional group [1]
- (d) (i) ethanol:

$$\begin{array}{c} \text{H} \quad \text{H} \\ | \quad | \\ \text{H}-\text{C}-\text{C}-\text{OH} \\ | \quad | \\ \text{H} \quad \text{H} \end{array}$$
 [1]
- propan-1-ol:

$$\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ | \quad | \quad | \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{OH} \\ | \quad | \quad | \\ \text{H} \quad \text{H} \quad \text{H} \end{array}$$
 [1] [2]
- (ii) propan-2-ol [1]
- (iii) **indicative content:**
 sugar [1]
 in water/solution [1]
 yeast [1]
 anaerobic conditions [1]
 warm [1]
 carbon dioxide produced [1]

Response	Mark
Candidates must use appropriate specialist terms to fully explain the process (using 5–6 points of indicative content). They use excellent spelling, punctuation and grammar and the form and style are of a very high standard.	[5]–[6]
Candidates must use appropriate specialist terms to explain the process (using 3–4 points of indicative content). They use good spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates briefly and partially explain the process (using at least 2 points of indicative content). They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1]–[2]
Response not worthy of credit	[0]

[6]

(e) (i) acidified [1] potassium dichromate [1]	[2]	AVAILABLE MARKS
(ii) orange to green	[1]	
(iii) oxidation	[1]	
(iv) $\text{Mg} + 2\text{C}_2\text{H}_5\text{COOH} \rightarrow (\text{C}_2\text{H}_5\text{COO})_2\text{Mg} + \text{H}_2$		
correct formulae of reactants [1]		
correct formulae of products [1]		
correct balancing [1]	[3]	
(v) any three from:		
magnesium/grey solid disappears [1]		
solution remains colourless [1]		
fizzing/bubbles/gas produced [1]		
heat released [1]	[3]	25

- 4 (a) pipette, burette, conical flask, pipette filler
all four [2]; one error or omission [1]; two errors or omissions [0] [2]
- (b) moles of NaOH = $\frac{25.0 \times 0.088}{1000} = 0.0022$ [1]
 moles of H₂SO₄ = $\frac{0.0022}{2} = 0.0011$ [1]
 concentration of H₂SO₄ = $\frac{0.0011 \times 1000}{17.6} = 0.0625$ [1] [3]
- (c) $0.0625 \times 98 = 6.1$ [1]
 (answer of 6.13/6.125 = [1]) [2]
- (d) $322 - 142 = 180$ [1]
 $\frac{180}{18} = 10$ [1] [2]

AVAILABLE
MARKS

9

			AVAILABLE MARKS
5	(a)	(i) $2\text{K} + 2\text{H}_2\text{O} \rightarrow 2\text{KOH} + \text{H}_2$ correct formulae of reactants [1] correct formulae of products [1] correct balancing [1]	[3]
		(ii) pink	[1]
		(iii) lose electron(s) [1] form K^+ [1]	[2]
		(iv) Group 1 more reactive than Group 2 [1] Suitable evidence from table [1]	[2]
	(b)	(i) $\text{Fe}_2\text{O}_3 + 2\text{Al} \rightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$ correct formulae of reactants [1] correct formulae of products [1] correct balancing [1]	[3]
		(ii) aluminium is more reactive than iron	[1]
	(c)	lead oxide loses oxygen [1]	
		loss of oxygen is reduction [1]	
		carbon gains oxygen [1]	
		gain of oxygen is oxidation [1]	
		redox is oxidation and reduction occurring in the same reaction [1]	[5]

			AVAILABLE MARKS	
6 (a) (i)	decomposition (of a liquid electrolyte) using (a direct current of) electricity	[1]	20	
(ii)	ions can move and carry charge	[1]		
(iii)	yellow-green/green [1] gas [1]	[2]		
(iv)	graphite	[1]		
(v)	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$ Cl ⁻ on left → Cl ₂ on right [1] + e ⁻ on right (or – e ⁻ on left) [1] correct balancing [1]	[3]		
(b) (i)	hydrogen	[1]		
(ii)	$4\text{OH}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^-$ OH ⁻ on left → and O ₂ and H ₂ O on right [1] + e ⁻ on right (or – e ⁻ on left) [1] correct balancing [1]	[3]		
(c) (i)	bauxite	[1]		
(ii)	$2\text{Al}(\text{OH})_3(\text{s}) \rightarrow \text{Al}_2\text{O}_3(\text{s}) + 3\text{H}_2\text{O}(\text{g})$ correct formula of reactant [1] correct formulae of products [1] correct balancing [1] correct state symbols [1]	[4]		
(iii)	lowers melting point/increases conductivity [1]	[1]		
(iv)	aluminium ions/Al ³⁺ gain electrons [1] gain of electrons is reduction [1]	[2]		
Total				100